

Laparoscopic-Assisted Resection of Right-Sided Colonic Carcinoma: A Case-Control Study

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Background and Objectives: Laparoscopic-assisted resection of colorectal carcinoma is technically feasible. Whether it is beneficial to patients is uncertain. This study reviewed the results of laparoscopic-assisted resection in patients with right-sided colonic adenocarcinoma.

Methods: We attempted laparoscopic-assisted right to extended right hemicolectomy in 28 patients with right-sided colonic carcinoma (study group). The results were compared with 56 matched patients who underwent conventional open resection in the same period (comparative group).

Results: The median follow-up times for the study and comparative groups were 21.4 and 23.5 months, respectively. The operating time was significantly longer (*t*-test, $P < 0.001$), whereas the time to resuming normal diet (Mann-Whitney *U*-test, $P < 0.001$) and the duration of hospital stay (Mann-Whitney *U*-test, $P = 0.002$) were significantly less in the study than in the comparative group. The oncological clearance, in terms of the number of lymph nodes removed and the resection margins, the complication rate, the disease-free rate, and the survival rate were comparable in the two groups.

Conclusions: We conclude that laparoscopic-assisted resection of right-sided colonic adenocarcinoma has the advantage over open surgery of allowing earlier recovery. However, this is at the expense of a longer operating time. *J. Surg. Oncol.* 1999;71:97–100. © 1999 Wiley-Liss, Inc.

KEY WORDS: colorectal tumor; right hemicolectomy; laparoscopic resection

INTRODUCTION

Since the introduction of laparoscopic cholecystectomy, laparoscopic surgery has been attempted and applied to many surgical operations [1]. Its application in colorectal malignancy is controversial because of the lack of data from good control trials and the reports on early port site tumor recurrence [2–4]. We previously reported that laparoscopic resection of rectosigmoid tumor allowed earlier recovery without jeopardizing oncological clearance compared with open surgery [5]. The results of this study, however, cannot be extrapolated to right-sided colonic adenocarcinoma because technically laparoscopic surgery to a right-sided tumor is completely different from that of a rectosigmoid tumor. A separate study is necessary. In this study, we reviewed the results of lap-

aroscopic-assisted resection for patients with right-sided colonic adenocarcinoma. A matched group of patients, with resection by conventional open technique carried out in the same period, was used as a comparative group.

MATERIALS AND METHODS

From January 1993 to July 1997, 28 laparoscopic-assisted right or extended right hemicolectomies were attempted for carcinoma. We excluded the following

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groups of patients for laparoscopic-assisted colectomy: patients with tumor larger than 6 cm, patients with tumor infiltrating the adjacent organs on ultrasonography and/or computerized tomography, patients who had previous major abdominal operations near the field of the colorectal operation, patients who did not consent to the procedure, and patients who presented with intestinal obstruction or perforation.

All patients underwent preoperative colonoscopy and biopsy of the tumor. Barium enema was performed to confirm the site of the lesion. Ultrasonography was used to gauge the size of the tumor and to look for evidence of local infiltration and/or distant metastasis. Computerized tomography was performed if the patients had advanced or bulky disease. Bowel preparation was with 4 l of polyethylene glycol electrolyte solution the day before operation. Systemic prophylactic antibiotics consisting of 750 mg cefuroxime and 500 mg metronidazole were administered intravenously at induction of anesthesia. Urinary catheter and nasogastric tube were routinely used.

The operations were performed by surgeons experienced in both laparoscopic and colorectal surgery. Our laparoscopic approach has been reported previously [6], but there were some modifications in the later cases. Initially we put the patients in the Lloyd Davies position. Pneumoperitoneum was created by open technique. Three 12 mm working ports were inserted under direct vision: two suprapubically on either side and one at the right upper quadrant. The chief surgeon operated between the legs of the patient. In the later cases, we put the patient in a supine position. One port was inserted suprapubically in the midline, a second one on the left side at the level of the umbilicus, and a third one at the epigastrium midway between the umbilicus and the subcostal angle. With the new arrangement, it was easier to mobilize the hepatic flexure, to divide the gastrocolic ligament, and to perform an extracorporeal anastomosis. The patient was tilted to the left with head downward. The terminal ileum, cecum, and ascending colon were completely mobilized up to the level of hepatic flexure, with particular attention to safeguard the ureter and the duodenum. The patient was then tilted head upward to facilitate the division of the gastrocolic ligament and the mobilization of the transverse colon and hepatic flexure. The ileocolic vessels, the right colic vessels, and if necessary the middle colic vessels were identified and transected with endoGIA (US Surgical Corp. AutoSuture, Norwalk, CT) close to their origins. The upper abdominal wound was then extended to the left to deliver the bowel and tumor under the protection of a plastic bag. The divisions of remaining mesentery, marginal artery, and bowel, as well as the ileocolic anastomosis, were performed extracorporeally. Postoperatively, diet was resumed as soon as bowel function returned clinically. Pethidine hydrochloride (meperidine by hydrochloride; 1

TABLE I. Demographic Data of Patients Included in Study of Laparoscopic-Assisted Resection of Right-Sided Colonies Carcinoma

	Study group (4 converted cases included)	Comparative group
No. of patients	28	56
Sex ratio (M:F)	15:13	30:26
Age (years, mean \pm SD)	69.6 \pm 10.3	65.0 \pm 13.4
Extended right hemicolectomy	4	9
TNM staging (I/II/III/IV)	3/12/7/6	6/24/14/12
Length of tumor (cm, mean \pm SD)	4.8 \pm 2.1	4.8 \pm 1.8
Follow-up time (months, range and median)	0.3–62.7 (21.4)	0.3–65.8 (23.5)

TABLE II. Complications and Deaths After Laparoscopically Assisted Resection of Right-Sided Colonic Carcinoma

	Study group (4 converted cases included)	Comparative group
Anastomotic leak		1 (1 ^a)
Pneumonia	1	2 (1 ^a)
Deep vein thrombosis		1
Heart failure	1 (1 ^a)	
Wound infection	2	
Urinary tract infection		1
Death	1	2

^aNumber of patients who had died of the complication.

mg/kg) was given 4-hourly on demand. The patients were discharged home when fully ambulatory.

The following parameters were measured prospectively: operation time, postoperative analgesic requirement, time to resuming normal diet, duration of hospital stay, morbidity, and mortality. The specimens were fixed unpinning and examined for margin clearance and TNM staging. All patients were followed up regularly at 3 monthly intervals for clinical examination and carcino-embryonic antigen testing.

To increase the power of the statistical tests, 2 controls for every case (i.e., 56 patients), with similar exclusion criteria, but matched in sex, age, TNM staging, tumor length, tumor site, and extent of resection, were randomly selected from a pool of 157 patients who underwent open conventional resection in the same period. Chi-square test, Student *t*-test, and Mann-Whitney *U*-test were used to compare categorical, parametric, and non-parametric data, respectively. Survival and disease-free intervals were calculated by the Kaplan-Meier method; differences between groups were compared with the log-rank test. *P* = 0.05 was considered significant.

RESULTS

The demographic data of the two groups of patients are shown in Table I. The median follow-up times were 21.4

TABLE III. Operation Time, Analgesic Requirement, Time to Resuming Normal Diet, Hospital Stay, and Oncological Clearance

	Study group (4 converted cases included)	Comparative group	<i>P</i>
Operation time (min, mean \pm SD)	191.8 \pm 34.5	148.6 \pm 41.7	<0.001 ^a
Postoperative analgesic requirement (No. of injections, range and median)	0–30 (4)	0–26 (5)	0.67 ^b
Time to resuming normal diet (days, range and median)	2–6 (4)	2–11 (5)	<0.001 ^b
Hospital stay (days, range and median)	2–12 (5)	4–53 (7)	0.002 ^b
Lymph nodes removed (No., range and median)	5–29 (16)	4–81 (16)	0.84 ^b

^aStudent *t*-test.^bMann-Whitney *U*-test.

months for the study group and 23.5 months for the comparative group. Four patients in the study group required conversion to open surgery because of unexpectedly bulky tumor (2), bleeding (1), and failure to mobilize the hepatic flexure (1). The mean length of the upper abdominal wound in successful laparoscopic-assisted colectomy was 6.5 cm.

There was no significant difference in the incidence of complications in the two groups (Table II). In the study group, one patient with bulky disease, conversion to open surgery, and involved lateral margin on histology died of refractory heart failure 9 days after surgery. In the comparative group, one patient with multiple liver metastases died of pneumonia on postoperative day 9, and another patient died of anastomotic leak and sepsis after reoperation.

The operating time was significantly longer in the study group than in the control group (Table III), while the time to resuming normal diet and the duration of hospital stay were significantly less (Table III). The oncological clearance, in terms of the number of lymph nodes removed and the resection margin, was comparable in the two groups (Table III). Two patients with advanced local disease, one from each group, had lateral margin involvement.

The 5-year survival rates after curative resection were 90.9% for the study group and 55.6% for the comparative group. The difference is not significant ($P = 0.07$ by log-rank test). The respective disease-free rates were 95.2% for the study group and 74.7% for the comparative group. The difference is again not significant ($P = 0.12$ by log-rank test). One patient in the study group and 9 patients in the comparative group had tumor recurrence (Table IV). There was no port site or wound recurrence in either group. In the study group, a patient, who was known to have peritoneal seedlings during operation, was found to have an abdominal wall tumor nodule 4 months after operation.

TABLE IV. Site Where Recurrence First Noticed (Palliative Cases Excluded)

	Study group (4 converted cases included)	Comparative group
Liver		5
Lung		2
Carcinomatosis peritonei		1
Anastomosis	1	
Supraclavicular lymph node		1
Total	1	9

DISCUSSION

Whether laparoscopic resection should be done for colorectal cancer is controversial. Good data in the medical literature are scarce and the early studies were either cohort studies on heterogeneous groups of patients or non-comparative studies [7–9]. From the limited information for right-sided colonic cancer carried out in a single medical center, the currently available data suggest that laparoscopic resection had the same morbidity [10] and oncological clearance [11] as in open surgery, but it was more expensive and did not improve postoperative recovery [12]. The authors, in these studies, however, were conservative in starting diet on their patients (~7 days) and in discharging their patients home (~12 days). Nevertheless, these studies showed that patients in the laparoscopic group regained full ambulation earlier.

Our study confirmed that the morbidity and oncological clearance were similar for the laparoscopic-assisted group compared with the conventional open group. In addition, patients in the laparoscopic-assisted group resumed normal diet and were discharged from hospital earlier than the open group. There was no difference in the analgesic requirement, which can be explained by the small sample size or the relatively long wounds used for specimen retrieval in the study group. We have not investigated the cost effectiveness of the laparoscopic procedure as the skill and the technique are still evolving,

and new instruments of more competitive cost are produced by the manufacturers.

The risk of tumor dissemination is the major concern in laparoscopic surgery for colorectal malignancy [13,14]. In our series, a patient, who was known to have peritoneal seedlings during operation, was found to have a tumor nodule in the abdominal wall 4 months after operation. Similar wound deposits also happen in open surgery. In a recent survey by the American Society of Colon and Rectal Surgeons, the incidence of wound recurrence after laparoscopic resection of colorectal cancer was 1.1%, which was essentially the same as that in open surgery [15].

Although there may be selection bias in this case-control study as patients' allocation was not done at random, the data suggest that laparoscopic-assisted colectomy for right-sided colonic cancer gave the same oncological clearance, disease-free interval, and patient survival compared with open colectomy. This is done at the expense of a longer operation time. A randomized study is necessary to prove the true value of laparoscopic-assisted colectomy for colonic cancer.

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